Facility Disposition Program at LLNL (1994-2015)

Primary Data Per the FY06 Ten Year Comprehensive Site Plan

Lawrence Livermore National Laboratory

November 2006

UCRL-AR-226514

DISCLAIMER

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November 2006
UCRL-AR-226514
IFM-06-0042

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Foreword

As part of its Surplus Facility Disposition Program, Lawrence Livermore National Laboratory (LLNL) has developed a number of safe, cost-effective processes for Decommissioning, Deactivating, Decontaminating, and Demolishing (D, D, D and D) surplus facilities. The actual and projected accomplishments are summarized to illustrate the progress and expected impact of managing LLNL's "surplus portfolio" based on the following criteria: (1) using the FY06 Ten Year Comprehensive Site Plan (TYCSP)[1] as the core data reference beyond 2002, (2) assuming that the projected Facility Infrastructure Recapitalization Program (FIRP) is funded to realize the goals stated in the FY06 TYCSP, and (3) all costs are fully burdened. (Historic costs through FY05 are reported in "as spent" dollars. All projected costs are as listed in the FY06 TYCSP.)

This report summarizes dispostion at LLNL through FY05. LLNL constructed its multi-year program to significantly reduce the footprint of both the total number, and square footage, of surplus facilities and eliminate many of the historically hazardous legacy facilities.

Future changes in budgets, Department of Energy (DOE) programs, and LLNL organizations may impact detailed projections, but the core D, D, D and D processes and associated organizational structures remain viable and offer a valuable strategy for managing legacy and surplus facilities.

Preface

When a new laboratory facility is constructed to address the nation's national security mission, the specific goals, capabilities, and tasks to be accomplished in the facility are documented in significant detail. When the projects that justified the initial investment are completed, the facility typically evolves to meet new mission needs. In a nominal 40 to 50 year lifetime of a permanent building, many diverse projects, with varying levels of historical documentation, will have started and stopped that may involve a large spectrum of hazards and associated materials. Ideally, when a project is completed, the laboratory will be deactivated and cleaned up before a new project begins. Since achieving perfect cleanup is sometimes impractical, most old research laboratories tend to accumulate a historical record of the work done during its useful life.

Before the facility can be decontaminated and demolished, the legacy radioactive, chemical, and/or biological residues that are potentially hazardous must be found, evaluated, and removed for safe, environmentally sound, and cost-effective disposition. Accomplishing this task requires a focused, well organized, expert team that excels in forensics, development, and execution of safe practices, hazard assessment and remediation, micro to macro demolition, waste management and disposal, and many other exotic and conventional hazardous operational skills and capabilities.

Although the physical deconstruction and/or demolition of the concrete and steel is probably the greatest potential hazard to the workers, the most challenging aspect of decontaminating and demolishing (D&D) old scientific facilities is that many residual hazards can be found only during the actual demolition. Surgically removing these residuals is the difference between 99+% recycle and the very costly management of hundreds of tons of steel and concrete characterized as hazardous, radioactive, or mixed waste.

LLNL developed a team approach to D&D that demonstrates the full set of skills and capabilities to "peel the onion" of end-of-life research buildings to identify all legacy hazards while minimizing hazardous waste and associated hazards of conventional D&D. This report describes this process, the team approach, and results of almost 10 years of evolution to the Laboratory's present capabilities. This approach is consistent with the Laboratory's 50-year tradition of "integrating multiple disciplines to solve complex problems."[2]

Section 1 Executive Summary

It is a challenging task to provide the scientific, engineering, and operational facilities and infrastructure to meet the rapidly changing missions of a national security laboratory. It requires a suite of mutually supportive technical and management competencies that are actively supported by senior Laboratory and University management and its sponsoring organizations (Department of Energy [DOE]/National Nuclear Security Administration [NNSA]). The core processes, practices, and top-level facility management accomplishments of Lawrence Livermore National Laboratory's (LLNL's) 10-year effort are documented in the *Pilot Program Report on Site Planning and Facility Maintenance Management at the Laboratory*.[3] The key elements of that report enabled much of the success of LLNL's facility management program. In support of the DOE/NNSA Facility and Infrastructure Recapitalization Program (FIRP), the *Pilot Program Report* specifically highlights some of the tools and significant progress in managing, stabilizing, and now, under FIRP, reducing the historical deferred maintenance backlog at LLNL, emphasizing mission critical facilities. In addition, a major element in stabilizing and tracking the reduction of maintenance backlog was the development of a predictive model that manages and reports reductions in total backlog under FIRP.

Strategic direction to management of the facility investments at LLNL began in 1997 with the creation of an Institutional Facilities Manager (IFM), a senior manager, reporting to the Laboratory Deputy Director for Operations. With the visible support of senior LLNL and DOE management and consistent with the objectives of DOE Order 430.1B, Real Property Asset Management (RPAM), the IFM, LLNL Facility Management and Plant Engineering team has made significant progress in *"establishing a corporate, holistic, and performance-based approach to real property life-cycle asset management that links real property asset planning, programming, budgeting, and evaluation to program mission projections and performance outcomes." (RPAM, p1)*. LLNL's integrated Facility and Space Management Program has been reviewed extensively and a number of LLNL facility management processes have been identified as "best practices" by the Committee on the Renewal of Department of Energy Infrastructure Board on Infrastructure and the Constructed Environment Division on Engineering and Physical Sciences National Research Council (NRC).[4]

A significant component of cost-effective facility lifecycle (and backlog reduction) management is the safe and efficient disposition of surplus and substandard facilities. At LLNL this function is centrally managed and prioritized by the IFM in support of the total Laboratory mission. A dedicated, highly skilled, and disciplined team, the Space Action Team (SAT), executes all aspects of surplus facility disposition, beginning with the surplusing process, reassignment or demolition assessment, and ending with reassignment or demolition (discussed in sections 2 and 3).

Currently, LLNL has more than 500,000 gsf of surplus facility space being managed under a risk-graded Surveillance and Maintenance (S&M) plan. Space that can be cost effectively integrated into the Laboratory's future missions is removed from surplus. The remaining space is managed at the lowest cost, safe configuration until D&D funds become available.

Although the highest facility related risks to the Laboratory reside in hazardous, process contaminated facilities, the limitations on available funding have dictated that most demolitions of substandard buildings were temporary or conventional office facilities that were significantly beyond their useful life. To make some progress on the more challenging task of reducing contaminated facilities, the IFM agreed to accept "ownership" from the Directorates of recently active contaminated facilities if the most recent "owner" removed all process equipment and cleaned up any contamination which occurred during their occupancy. Unfortunately, in a Laboratory older than 50 years, some of the most contaminated buildings had lost programmatic support years long before the most recent occupant assumed responsibility for its operation.

Beginning in 1998, indirect funding was allocated to stabilize and clean up the most serious process contamination in these facilities (i.e., Type II^{+}/legacy*). After cleanup, some were reusable, but most were stabilized at a safe, lowest-cost configuration, awaiting funding for final disposition. When NNSA's FIRP was created, Congress allocated significant funding from FY02 to FY09 to decrease NNSA's *non-process contaminated* facility footprint (see Appendix C). Because of these earlier investments, LLNL had a number of previously contaminated buildings that met the FIRP criteria for being funded for demolition.

* Type II^{+}—concrete–steel construction with a history of contamination and hazardous/ radioactive operations.

As documented in LLNL's FY06 TYCSP, approximately one third of the 618K gsf slated for demolition under FIRP, was previously process contaminated. Demolition of Building 222 South was completed in FY03 for $214 per square foot (FY03 dollars) and benchmarked favorably with CH2MHill Rocky Flats Environmental Technology Site (RFETS) "best in class" experience at Rocky Flats for a building of comparable complexity and residual contamination (see section 2.1.7). As stated in NNSA's FIRP Execution Plan (November 2004), goals for average demolition costs are $122 per square foot. LLNL built a D&D project plan as a risk and cost balanced portfolio of temporary buildings and permanent concrete structures with and without a history of contamination. As a result, LLNL has met the intent of congressional language to eliminate square footage as a first priority and also, as recommended by the NRC, reduced a significant number of legacy facilities.

This strategy reduces the Laboratory and NNSA risk and facilitates the Laboratory in meeting the NNSA average demolition cost goals over the FIRP funding period. At the end of 2006, LLNL will have demolished more than 650K gsf since 1994. Thus far the cumulative average cost of FIRP demolition is under $100/gsf and is projected to remain so until the end of the program. As shown in Figure 1, current plans project that an additional 500K square feet will be removed by FY15 if projected budgets are maintained.

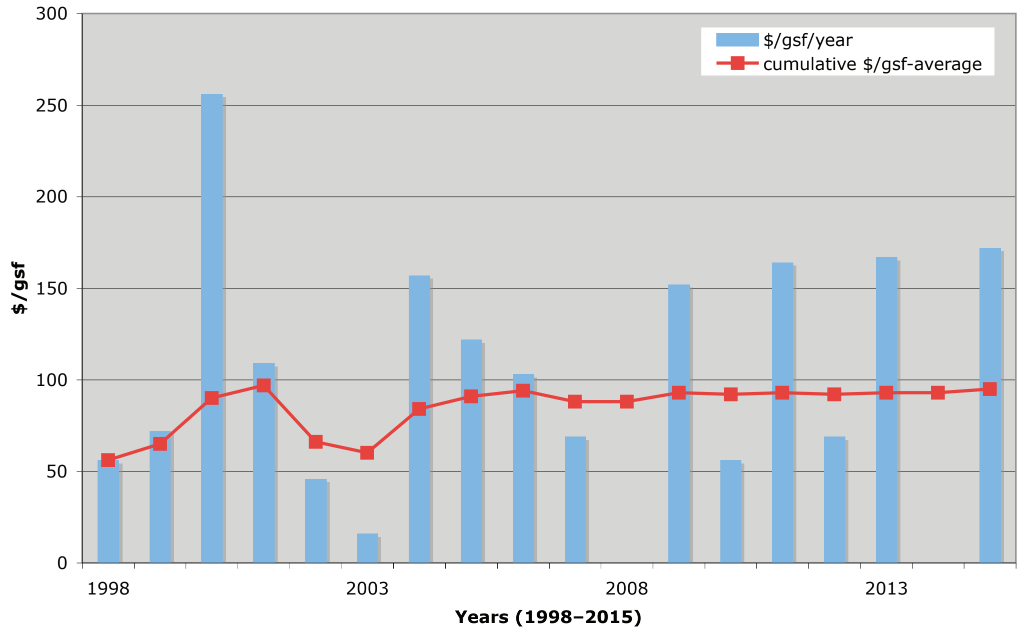

Figure 1. The actual and projected average annual cost per square foot for D&D of all types of facilities (1998 to 2015). In addition, the cumulative average cost over this period is plotted to illustrate the ability to maintain a portfolio average below the NNSA goal of $122/gsf and also demolish a number of potentially hazardous facilities. (Spike in FY2000 due to small annual gsf (7268) and expensive cleanup of plutonium residue.) Actual costs are fully burdened "as spent" dollars. Projected costs are as documented in the FY06 TYCSP.

To the degree practical, sound surplus facilities are cleaned up and sometimes renovated to optimize their reassignment potential. Between 1994 and 2001, the Laboratory had removed over 260K gsf of surplus, worn out buildings and utility structures. In the same period a number of structurally sound facilities were renovated to restore and/or modernize over 1000 previously substandard offices. Between 2003 and 2006, four new space and energy efficient permanent buildings replaced non-salvageable substandard temporary housing and eliminated nearly $1M in maintenance backlog. These new buildings share a standardized design for a nominal 100 workstations per each configuration using a "best value" design–build concept. Thus far each new General Plant Project (GPP) funded (Institutional and FIRP) building has yielded excellent and improved per square foot construction costs, quality, energy efficiency, and space utilization.

Based on the principles documented in the *Pilot Program Report, Site Planning and Facility Maintenance Management at Lawrence Livermore National Laboratory* (see Table 1 for highlights) and practiced over the past 10-years, LLNL has been able to develop and demonstrate a safe, cost-effective, and environmentally sensitive cleanup and demolition capability:

- In more than 350,000 hours of demolition activity, there were only two lost work days,
- Demolition costs averaged less than $100/gsf,
- Recycling has been maintained at greater than 95%, and
- To date LLNL actual costs are within 1% of the total estimated costs in the FY06 TYCSP Attachment E.

As demonstrated at LLNL, these core-capabilities are critical in managing and executing an effective D&D program. See Appendix A for detailed Case Studies that summarize and expand this discussion.

Table 1. Key elements of a successful site planning and maintenance management program.

Leadership

- Senior management who are committed to safe, cost-effective, and mission-responsive facility management
- An independent champion who strategically manages the institutional facility investment portfolio and facilitates action for beneficial change to normalize rankings and maintain the integrity of the maintenance process
- Knowledgeable facility "owners" who assure safe operation of their real-property systems and understand the operational requirements of these systems
- A culture that encourages constructive innovation and enhanced productivity

Partnership

- Independent programmatic and facility management chains with defined roles, responsibilities, and authorities for programmatic, real property, and associated facilities and systems
- Active and effective dialogue and planning between programmatic and facility management teams to identify facility investments required to support new mission capabilities or to modify existing facility assets to accommodate changes in facility requirements

Planning and Controls

- Efficient space-management processes:
  — to manage surplus space in a safe and cost-effective manner
  — to clean up and demolish substandard facilities with environmentally and economically sound processes
  — to establish an equitable space tax as an incentive to use space efficiently
- Processes and procedures (e.g., DOE orders) that facilitate the use of the safest, most efficient, and cost-effective tools and methods to achieve the performance required by the mission
- Integrated external and self-assessment processes to provide feedback and improve planning and controls
- A valid process and system for assessing facility conditions

Execution

- Centralized expertise to execute a well-integrated maintenance management program
- An integrated model with transparent metrics to track and evaluate actual progress and to project the expected gains from future investments
- Aggressive resource management to establish budgets, track funding, and evaluate results
- Systems to identify all real-property assets, evaluate their mission importance, and determine their reliability or probability of failure
- Well-integrated processes to capture and prioritize all the elements that make up the total facility investment and management portfolio

Section 2 Facility Disposition Program at LLNL

A significant component of an effective institutional facility management plan is management of surplus facilities. The concept of managing surplus facilities for the best value of the Laboratory mission is similar to the success of stabilizing the deferred maintenance backlog by proactively investing in prioritized mission-critical maintenance. The discussion of surplus property management and disposition is in the context of risk reduction, application of safe, environmentally sound and cost-effective practices, and most importantly, providing significant support to the Laboratory's national security mission.

Section 2.1 LLNL's Facility Management System

Beginning in 1997, all surplus space was assigned to the IFM to centrally manage and prioritize the total disposition process: to return and actively manage surplus facilities accepted by the Institution to improve organizational space utilization and, in parallel, to invest in restoring sound facilities and reducing the number of non-reusable surplus facilities. The IFM Office actively assists operational organizations in reducing or obtaining facility space, while minimizing institutional risks and associated management costs. The non-reassignable returned space is configured in a risk and cost balanced portfolio for demolition as funds become available. Safe and cost-effective elimination of substandard facilities is a high leverage component of the disposition program that eliminates significant maintenance backlog, reduces ongoing annual surveillance and maintenance costs and associated risks, and provides unrestricted sites for new or replacement buildings needed for the Laboratory's evolving mission.

Section 2.1.1 Relationships Among Deferred Maintenance, Surveillance and Maintenance, and Total Estimated Costs for D&D

In the FY06 TYCSP's Attachment E-1 formulation of the D&D element of FIRP, NNSA required its contractors to include the deferred maintenance (DM) and annual surveillance and maintenance (S&M) costs at the time of demolition along with the total estimated cost (TEC) for demolishing the surplus facilities. Although the long-term value of the D&D effort is the reduction per footprint of NNSA's facility portfolio and its operating costs, demolition of surplus facilities also eliminates the DM, S&M, modernization, seismic, and other code upgrade costs of those buildings. As discussed earlier, structurally and architecturally sound buildings are generally worth revitalizing to provide future capabilities, but investing to eliminate the DM of a worn out building is usually a poor investment. It is interesting to plot the cumulative total estimated cost (TEC) to remove the facilities listed in Attachment E-1 with the DM and S&M costs during demolition (see Figure 2 below). When the cumulative S&M and DM costs are added for the 2002 to 2015 period, this sum is substantially equivalent to the total D&D program TEC or nearly $80M. Not captured is the on going annual cost of S&M for unusable surplus facilities prior to D&D, which can not be considered until D&D funds are available. Over a long period of time the lack of D&D funds will generate a costly, and potentially unsafe, collection of abandoned and degrading facilities.

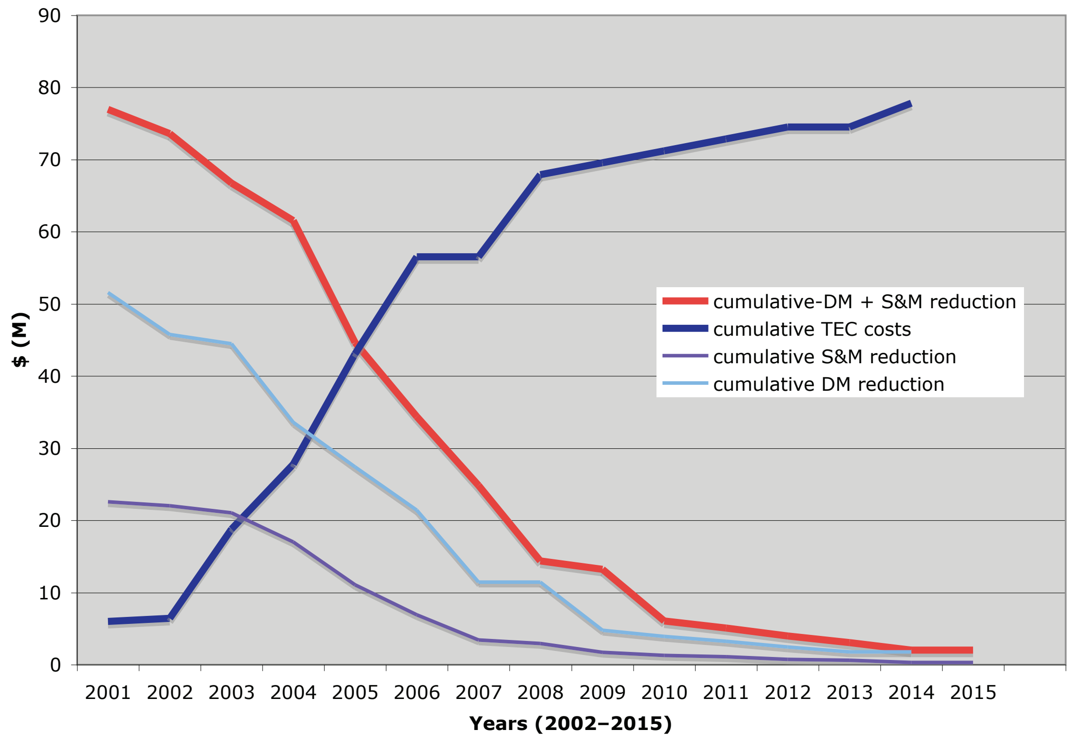

Figure 2. Plot showing DM, S&M, and TEC cost relationships for the total program. The ratio of the sum of DM and S&M costs to the TEC can be a useful metric for D&D decisions.

Section 2.1.2 LLNL's Evolution Leading to Site Cleanup

The removal or cleanup of significant substandard square footage began in 1994. Initially, most of the buildings removed were temporary or conventional office facilities that were significantly beyond their useful life. However, in the late 1990s the Laboratory's focus in meeting its national security mission evolved from experimental to more analytical approaches, creating a need to surplus older experimental facilities, many of which had a history of hazardous operations. These types of facilities represent the highest safety and environmental risks to the Laboratory. Beginning in 1998, a small but consistent annual budget (~$1.65M/yr) was created to continue removal of worn out trailers and begin the process of cleaning up and stabilizing the most serious contaminated legacy facilities. Removing unacceptable levels of process contaminated equipment and material made it possible to meet FIRP criteria allowing several of the previously contaminated buildings to be included in the FIRP Disposition Program. In FY02, the Laboratory's 50th anniversary, FIRP funding began removing the Building 222 chemistry complex that operated from the early 1950s until 1996.

An audit published by the DOE Inspector General criticized deactivating and decommissioning approaches that concentrate more heavily on near-zero risk facilities almost to the exclusion of the most hazardous.[5] Since LLNL began its site cleanup in the late 1990s, it has used a cost and risk balanced prioritization process to create the annual D&D project listing. Former highly contaminated facilities are ranked highest and a larger number of temporary or conventional facilities are included to achieve cumulative average costs below the NNSA stated goal of $122/gsf.

In some instances, the level of contamination and/or inventory of radioactive materials is too extensive or large to cleanup with the level of annual cleanup funding available. For example, a special project was separately funded over several years to deactivate and decommission the Laboratory's most challenging high-risk legacy facility—the Heavy Element Facility (Building 251, a legacy of the nuclear test program that was no longer needed after the end of testing). This project, managed and executed by the Laboratory's Environmental Protection Department, recently completed the transfer of nearly all the radioactive inventory and successfully downgraded the building from Category 2 nuclear to radiological. Demolition is projected to occur in 2008 and 2009, but the final disposition will be determined by the availability of funds at that time.

2.1.3 Efficient Space Utilization is A Key Metric in Effective Facility Stewardship

To provide an effective incentive to use space efficiently, all real property at LLNL has a well-defined and uniformly applied cost to facility owners and users. In the mid-1990s a space tax was introduced (Laboratory Facility Charge [LFC]), which is a single fixed cost per gross square foot levied on all maintained space (FY05 LFC $8.55/gsf). After adjustments in the late 1990s, the LFC has been adjusted for inflation to collect the annual funds required to maintain all the real property and operate the institutional facilities in a non-backlog growth condition. (One exception is funding for high-voltage electrical power systems operation and maintenance that collects from a user recharge.) Programmatic equipment and operations are typically directly funded.

In addition, to better understand and manage the cost of operating the Laboratory organizations, LLNL management formalized a standardized burden structure on the use of space, the organizational facility charge (OFC). The total OFC is determined by adding the using organization's operational costs needed to manage its space to the LFC. The LFC is typically between 20 and 30 percent of the OFC. (In FY06, this burden structure was modified but most of the features of the LFC were preserved.)

Knowing the cost of facility ownership and operation allows each Laboratory organization to define and prioritize its need for space. To be able to manage their space, a mechanism must exist to allow them to divest unneeded or surplus space. The IFM Office accepts surplus space from users, consistent with a standard checklist and set of procedures, and centrally manages it to a safe, lowest-cost condition. This office provides assistance to effect transfers, verify that the owners have completed all the necessary steps, and to expedite efficient reuse of viable space. Nonviable space is placed under a risk-graded surveillance and maintenance plan until it can be demolished. Once a transfer is complete, the previous owner is relieved of responsibility for the LFC. Since 1998, nearly 600K square feet of space has been "returned to the Institution" for reassignment or other disposition.

2.1.4 Planning for Effective Disposition

At LLNL, disposition of surplus space leading to enhanced facility utilization has become a strategically planned and managed program element of the Laboratory's Facility Management effort whose primary goals are risk reduction, lower facility management costs, and enhanced flexibility to meet future missions. When a programmatic or support organization surpluses a facility that they no longer need, it is assessed for its long- and short-term potential and its risks and liabilities. To the degree possible, the operational history of the facility is documented by thoroughly examining all applicable records and interviewing former building inhabitants, many of whom have been retired for some time.

2.1.4.1 Structurally Sound Facilities. Typically structurally sound facilities, that are not at their end of life, are maintained, and, if required, cleaned up to provide capability for future mission requirements. From the pre-transfer historical review, new occupants are given a full disclosure of historical liabilities to begin the creation of the documentation base that will be used when demolition becomes the disposition path.

2.1.4.2 Marginal-Value and Substandard Facilities. Facilities of marginal value are reviewed and prioritized for longer-term disposition. Substandard facilities are deactivated and turned to "cold and dark" status to lower operational costs of managing surplus space and, as funding permits, decommissioned to facilitate future decontamination (typical in older scientific buildings in the DOE complex). As funds become available, demolition projects are developed consistent with the portfolio prioritization, risk, and projected cost per square foot.

2.1.4.3 Demolition of Facilities. When demolition is the disposition path, planning and execution focuses on more in-depth analyses to identify any historical, structural, contamination, or logistical problems that then define the total staff, skill, equipment, safety and environmental requirements for a successful project. Working with a proven, well-defined process, each step of a project is captured in an associated resource loaded work plan. It is then scheduled and matched to specific skills, knowledge, and abilities of individuals in the Space Action Team (SAT), which is LLNL's project organization that manages and/or executes demolition activities.

Work begins only after all plans, training, documentation, utility locations, permits, and reviews are complete and all necessary financial and personnel resources are available. As described in the next section, when new skills and/or capabilities are required to proceed with a potential high risk activity, SAT formally develops, refines, and validates them in the field before any hazardous work begins. All team members must be skilled in executing hazardous work and are continuously trained to assure exceptional awareness and expertise in all operations, including standing down if the path forward requires additional assessment, planning, or process development. Once hands-on work begins, all members of the fully integrated D&D team actively review all aspects of the daily work to assure an ongoing, clean, safe, and efficient operation. This same cultural attitude is verified as a requirement for all contractors who participate in Laboratory D&D projects.

2.1.5 Actual and Projected D&D Accomplishments

The Laboratory has a fixed nominal one-square-mile Main Site and Congress has mandated no net growth in DOE's square footage. Therefore, each demolition project creates a parcel of unrestricted real estate that can be used to meet new programmatic facility requirements. Figure 3 (a–d) shows the elements to construct a cost balanced portfolio. Note the cumulative average remains under $100/gsf. Figure 3(a) illustrates the square footage reductions achieved or that will be available if the projections in Attachment E-1 of the FY06 TYCSP are realized by FY15.

FIRP contributions are plotted separately to demonstrate the significance of this funding and its impact on reducing the problem of managing surplus facilities. Also illustrated is the net footprint reduction that provides "banked square footage" for future construction.

2.1.6 Balanced D&D Portfolio

There is alignment between LLNL's D&D portfolio's structure and the NNSA's goals. When FIRP began in FY02, LLNL's earlier efforts in D&D provided enough experience and skill to develop high confidence project and cost plans covering the full spectrum of the Laboratory's surplus building categories. In the development of the TYCSP and, in particular Attachment E, addressing known historical Type II+(*) legacy facilities is a high priority for demolition. These highest risk projects were estimated to have D&D costs near $200 per square foot. However, approximately 30% of the Laboratory's offices were in temporary structures at or beyond their useful life that are removable for about $20 per square foot. In Attachment E-1 of the FY06 TYCSP, LLNL has recommended a D&D portfolio made up of a mix of Type II+, Type II, and temporary building types that provide an average D&D program cost below the NNSA goal of $122 per square foot. Figure 3(b) plots the gross square feet removed or planned to be removed between 1994 to 2015 that illustrates the facility mix planned or recommended in the FY06 TYCSP. If this D&D program is fully funded, removal of the Type II+ space in the summary chart would eliminate most of the high risk legacies at LLNL.

Before FIRP, nearly 260K gsf of worn out surplus space had been removed. Of this number, about 225K gsf were temporary structures. The remainder included small Type II and Type II+ buildings that were mainly projects to validate the D&D processes and tools that are now being employed on FIRP projects. During FIRP a significant percentage of the space being demolished, or to be removed, was temporary. Figure 3(c) presents the Figure 3(b) data as it accumulates over time and also includes "other" space funded by DOE Office of Science and Environmental Management. The long-term relative balance of types of space over the total program illustrates the eventual elimination of a significant percentage of LLNL's high risk facilities while also removing over 400K gsf of worn out temporary space.

When looking at the cost of this approach, Figure 3(d) shows that Type II+ facilities dominate when the annual dollar per square foot costs are plotted from 1998 to 2015 (the period for which there is reliable cost data). Type II standard concrete and steel structures fall in the $100 to about $150/gsf, and temporary facilities are typically below $20/gsf.

* Type II+: Concrete/steel construction with history of contamination and hazardous operations.

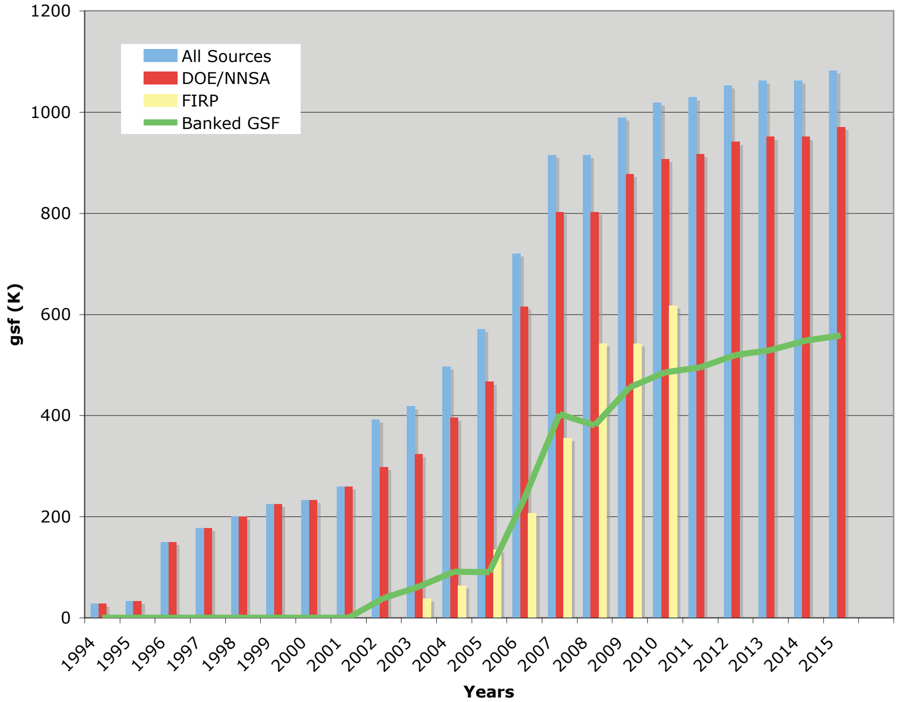

Figure 3(a). The cumulative summary of surplus space demolished or scheduled for demolition between 1994 and 2015 is plotted to illustrate the funding source and creation of new potential biulding space. Between 1994 and 2015 over 1M gsf of substandard space is projected to be demolished. Most of the footprint reduction (red) is DOE/NNSA space funded by FIRP or LLNL indirect funds, but some DOE Office of Science and Environmental Management funding has added about 10% to the total (blue). If the projections are realized, almost 600K gsf of new building space will have been created by the FIRP program (green). FIRP, plotted separately, will have provided more than 80% of the total funding for this outcome by 2015 (yellow).

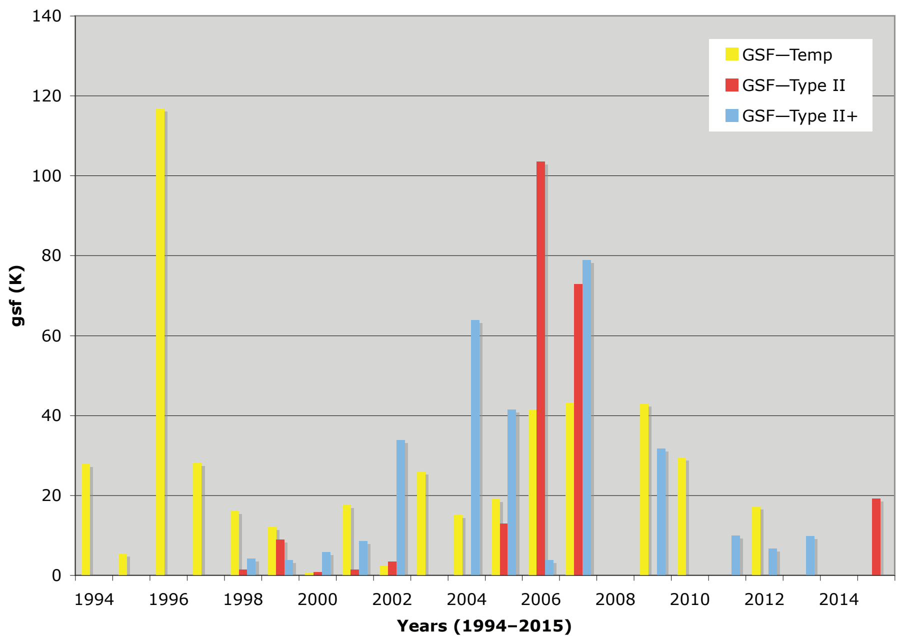

Figure 3(b). Summary chart of space removed or scheduled for removal by building type between 1994 and 2015.

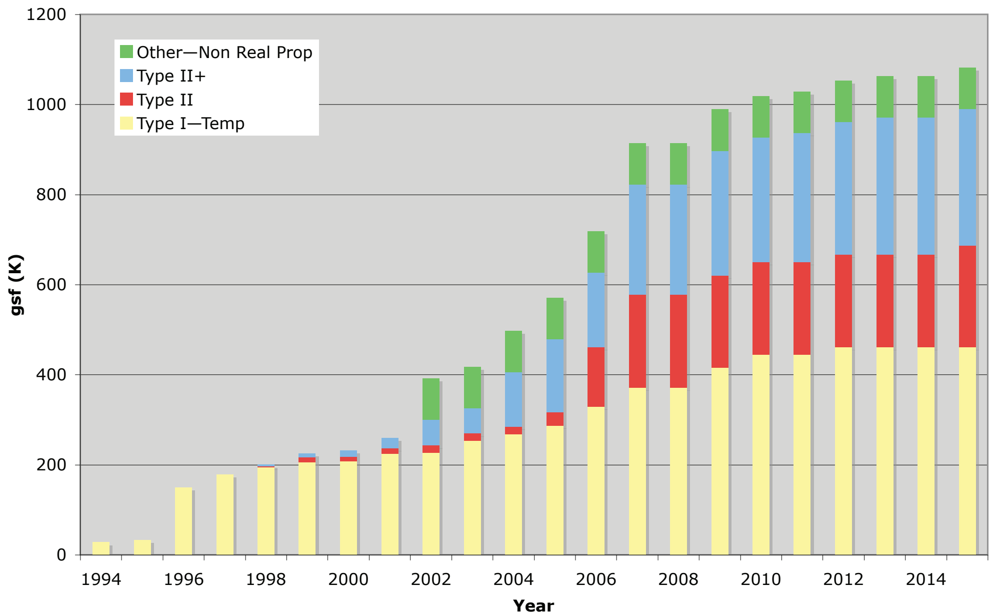

Figure 3(c). Plot of accumulated gross square feet demolished or scheduled to be demolished from 1994 to 2015 by building category.

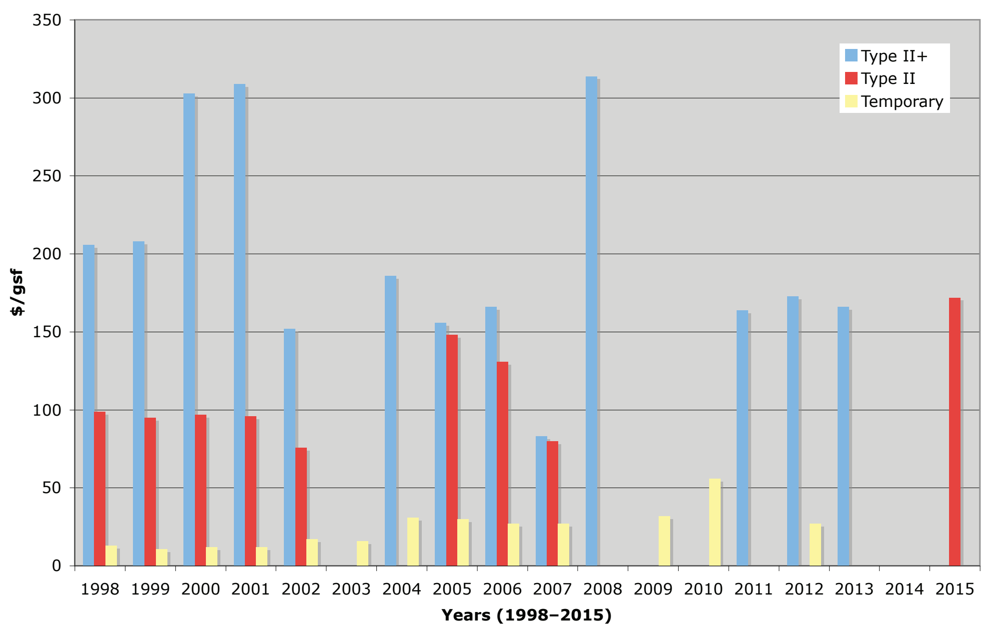

Figure 3(d). Summary of the annual cost of demolition per square foot between 1998 and 2015 by building category.

However, as shown in Figure 4, when the annual costs are cumulatively averaged over the program duration, Type II+ average to under $200/gsf and the portfolio cumulative average remains under $100/gsf for the entire period. From the beginning of FIRP D&D to the end of FY05, LLNL's actual costs are within 1% of the TYCSP TEC estimates providing some basis for achieving the long-term goal within the proposed budgets.

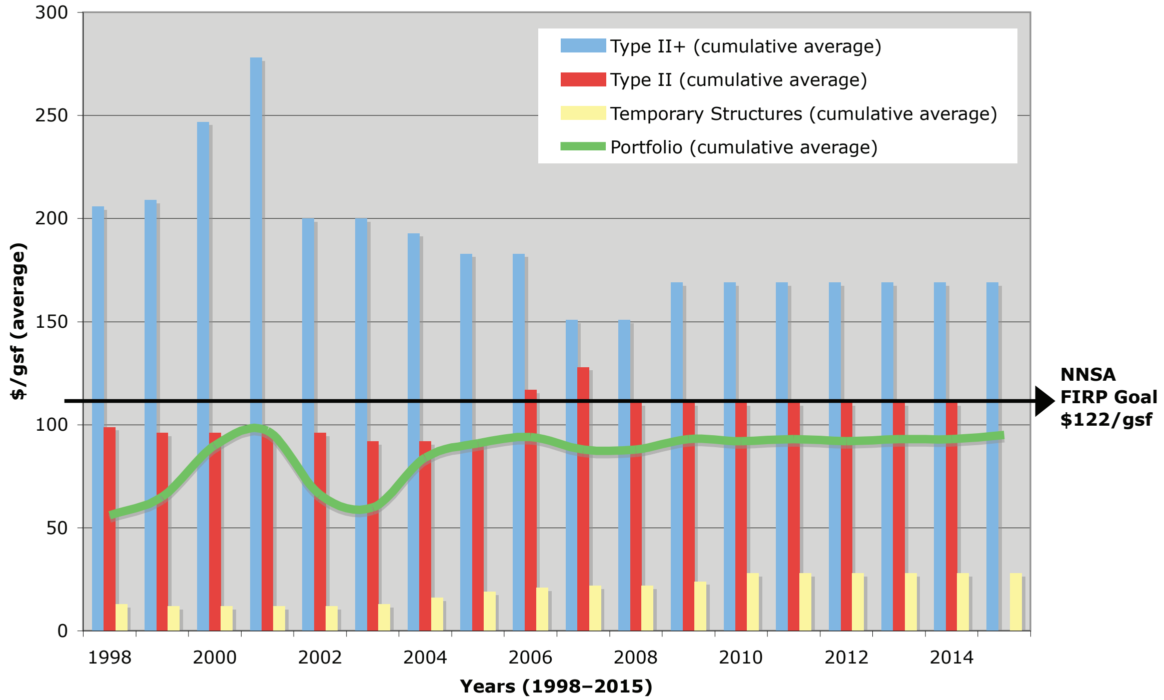

Figure 4. Tracking the running cumulative average of the costs of removing each category of space over the 1998–2015 interval illustrates that using a balanced portfolio approach achieves significant reductions in high risk space. Also significant is the achievement of excellent average costs by leveling the project mix with an appropriate portion of low cost/gsf temporary facilities. The ongoing as projected average costs per square foot are below, and are expected to remain below the NNSA goal of $122/gsf. Actual costs are fully burdened "as spent" dollars. Projected costs are as documented in the FY06 TYCSP.

2.1.7 Project Execution and Benchmarking

By FY02, LLNL's SAT had already established itself with the technical and financial successes on a range of D&D projects that demonstrated its ability to manage hazardous D&D projects cost effectively. Therefore, SAT was assigned the responsibility for FIRP disposition. As the Case Studies in Appendix A illustrate, there is a breadth and depth of skills SAT developed that directly apply to the FIRP D&D projects. SAT's capabilities to eliminate as many high-risk facilities consistent with keeping the average costs under NNSA's cost goals is a key success factor in the LLNL D&D program.

In the first year of FIRP in FY02, SAT began the demolition of Building 222 South (one section of the Type II+ Building 222 complex). The cost estimate was over $4M for a 19,444 gsf building. Therefore, NNSA requested LLNL to benchmark costs with CH2MHill [Rocky Flats Environmental Technology (RFETS)] because of their proven demolition successes. Following the demolition of Building 222S, and based on mutual visits of both organizations, RFETS personnel concluded that the costs reported by LLNL to complete Building 222S appeared to be comparable to their experience. Since this organization was recognized as "best in class," NNSA accepted LLNL's project costs near $200/gsf as reasonable and cost effective.

2.1.8 LLNL Total Disposition Portfolio (FY06)

In Attachment E-1 of the FY06 TYCSP, demolition projects are listed for the period from FY02 to FY15. Also listed are facilities that will be serious D&D candidates after 2015* that are planned but not funded (listed as TBD). Prior to FIRP, LLNL had demolished slightly more than 260K gsf between 1994 and 2001 with line item and indirect funding. FIRP is projected to remove nearly 620K gsf. After FY09 the present level of indirect funding allocated for D&D is projected to continue at $1.65M per year until FY15, potentially yielding an additional 92K gsf. In addition, several relatively small projects were funded by DOE Office of Science and Environmental Management. The 1994 to 2015 total from all sources is projected at more than 1M gsf.

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*TBD D&D candidates were defined as all non-mission essential facilities that will be more than 35 years old in 2015.

In this report all D&D at LLNL that occurred or is projected to occur between 1994 and 2015 plus the worn out "TBD" facilities remaining, that will need attention after FIRP, is defined as the Total Disposition Portfolio for D&D at LLNL. Figure 5 is a plot of the reduction in this portfolio as investments were, or are planned to be, made.

The reduction in the site RPV as a result of D&D is also plotted which closely follows the GSF plot. The total portfolio has a FY05 value of more than $915M. Beyond 2015, the future liabilities or "TBD" facilities have a $540M RPV. Completing the plan as listed in the 2006 TYCSP will remove worn out space having a RPV of more than $375M. FIRP accounts for $278M or nearly 75% of the 1994–2015 total, illustrating the potential for making a significant impact on a very large problem with a focused prioritized investment program. This summary also highlights the systemic challenge in 50+ year old sites. Even with an aggressive disposition program it is difficult and very expensive to keep up with aging facilities and infrastructure.

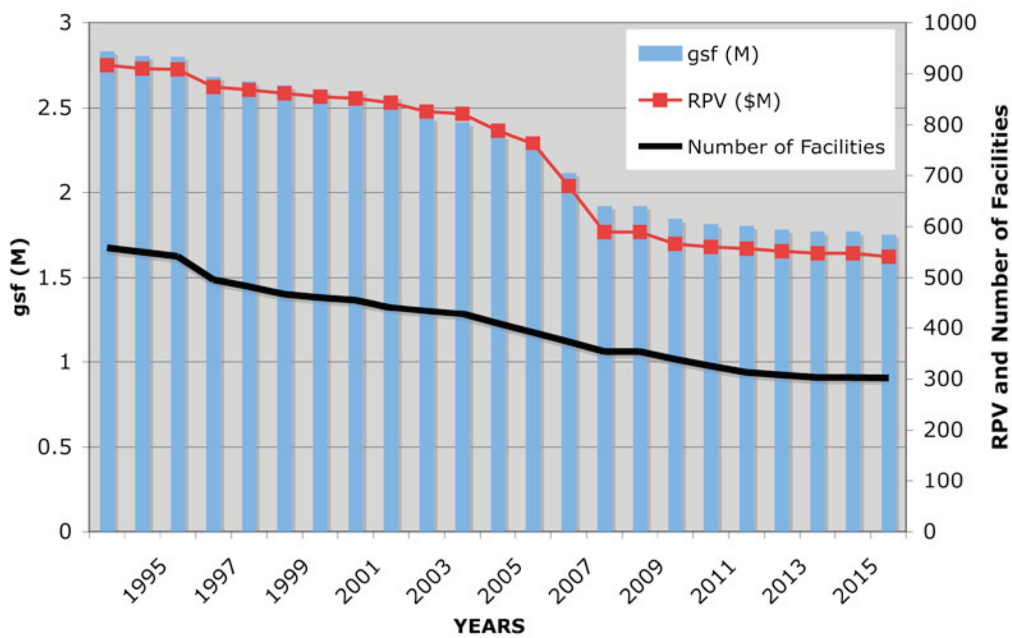

Figure 5. The total number of buildings in the TYCSP Attachment E portfolio is 558 (>2.8M gsf composed of 252 Type II or II+ and 306 temporary buildings). From 1994 to 2015, 256 buildings are scheduled for removal (101 are FIRP). After 2015, most of the 302 buildings listed in "TBD" will qualify for removal if funding is available (about 1.75M gsf).

Section 3 Integrated Safety and Environmental Management is an Essential Element of a Successful Disposition Program: Integrated Team Approach

Excellent organizations understand that environmental, safety, security, and health factors dominate risk management decisions. In 1995 the Chemistry and Materials Science (CMS) Directorate at LLNL developed a dedicated, centrally managed, multi-disciplinary team, the Space Action Team (SAT), to manage moves and modifications involving several hundred chemistry laboratories. Later, under IFM sponsorship, SAT successfully completed a pilot project to validate capability and establish a cost basis for fully decontaminating and demolishing five small (about 8200 gsf), but complex chemistry facilities, in the vicinity of the Building 222 complex.

SAT's demonstrated ability to integrate skills, knowledge, abilities, and lessons learned on smaller or less complex projects proved to be very effective. Based on SAT's history and success with the pilot project, the IFM assigned SAT institutional responsibility to clean up and eventually demolish non-reusable facilities.

3.1 Space Action Team (SAT) Structure and Characteristics

The dominant characteristic of SAT is its in-depth subject matter expertise, accumulated historical knowledge, experiential team understanding, training, and mitigation capability for all hazards associated with deactivating, decommissioning, decontaminating, and demolishing (D, D, D, & D) potentially hazardous facilities. Although chemical, radioactive, explosive, and other similar hazards dominate most safety analyses for a project, unmanaged industrial hazards are much more probable factors in work place accidents and injuries.

For over 10 years, SAT has demonstrated a working philosophy that work proceeds on the basis of a total, shared understanding of all potential hazards and a detailed plan for addressing those hazards. Each team member understands and supports strict compliance with regulatory requirements to protect each other, supporting contractors, the environment, and the community. SAT members engage in rigorous training and procedural development, and perform frequent dry runs for each project. During and after each project, there is a consistent practice to review lessons learned and the documentation for any future projects. Each successive project validates the capabilities for the next highest hazard project. A high premium is placed on team skill, stability, and experience to effectively integrate the awareness and new skills that result from these exercises.

Consistent with being a *real team,*[6] communication and mutual support results only when each team member has well defined and practiced roles and responsibilities that are personally accepted and understood by the rest of the team. Seamless integration of excellent leadership in the teams is an essential component to assure Laboratory management that the process works every day. For more than 10 years, hundreds of projects encompassing over 350,000 work hours have been successfully executed with only one reportable injury requiring 2 lost work days. Table 2 summarizes the key characteristics of the LLNL SAT team structure.

3.2 Lessons Learned

Appendix A–2 and Appendix B provide SAT project summaries to illustrate how an experienced team performs hazardous operations and prevents significant incidents. Lessons Learned from these events provide very useful and effective knowledge to manage future unexpected and potentially dangerous problems. Every new SAT member reviews LLNL's and other sites' Lesson Learned reports as part of required ongoing training.

Table 2. SAT Team Characteristics.

Leadership

- Institutional perspective and visible senior management support
- Collaborative goal setting and shared expectations
- Team accountability and feedback support
- Aggressive communication protocols

Project and Cost Management Tools

- High standards for work planning and execution
- Activity based costs and productivity goals analyzed and tracked to improve overall project performance
- Well developed parametric costing tools

Efficient ES&H Culture—Be the Best by Doing it Right

- Training and Certification (hazardous operations)
- Ongoing assessments (i.e., self, internal, and external)
- Adaptable and responsive to evolving requirements and expectations (i.e., ES&H, regulatory, and sponsor)
- Effective integration of Lessons Learned

Skills, Knowledge, and Abilities

- Multiple disciplinary skills matched to project specifics (i.e., institutional knowledge, decontamination, deconstruction, cleanup, waste management, and recycle skills)
- Comprehensive historical analytical capabilities to uncover the unknown (i.e., potential hazardous chemicals)
- Critical skill set and proactive communication style (i.e., resolve before proceeding)

SAT members are recognizable by their integrity, discipline, shared responsibilities and commitment, and pervasive "can do" spirit.

Section 4 Summary: Full and Enthusiastic Management Support is the Key to a "Best in Class" D&D Program

For over eight years, D&D at LLNL has been a strategically planned and managed program element of Institutional Facilities Management whose primary goal is risk reduction in safety, facility management costs, and flexibility to meet future missions.

At the working level to be successful, each project is subjected to in-depth analysis to identify any historical, structural, contamination, or logistical problems that then define the total staff, skill, equipment, safety, and environmental requirements. Working with a proven, team-driven process, each step of a project is captured in an associated resource loaded work plan and schedule.

Work begins only when all plans, training, documentation, and reviews are complete and all necessary financial and personnel resources are available. When team members need new skills and/or capabilities to proceed with a potential high risk activity, they are formally developed, refined, and validated in the field before any hazardous work begins. All team members involved in the D&D project must be skilled in executing hazardous work and are continuously trained to assure exceptional awareness and expertise in all operations, including standing down if the path forward requires additional assessment, planning, or process development. Once hands-on work begins, all members of the fully integrated D&D team actively review all aspects of the daily work to assure a clean, safe, and efficient operation. This same cultural attitude is verified as a requirement for all contractor participants in D&D projects. Integrating and refining these cultural attitudes in an organizationally stable project team over many years has been a key factor in its success.

With the full and enthusiastic support of Laboratory management, the outcome of the LLNL D&D Program has been exceptional. Obsolete, contaminated buildings have been replaced by clean, unrestricted use building lots that allow the Laboratory to construct new capabilities to meet its future missions. To date, LLNL has delivered complete projects on budget and on time. Without any compromise in safety or environmental stewardship, SAT has been recognized as "best in class" in cost effectiveness and project management.

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Acroynms and Definitions

DOE	Department of Energy
D&D	Decontamination and Demolition
D, D, D & D	Decommission, Deactivation, Decontamination, and Demolition
DM	Deferred Maintenance
FIRP	Facility Infrastructure Recapitalization Program
GPP	General Plant Project
gsf	gross square feet
IFM	Institutional Facilities Manager
LFC	Laboratory Facility Charge
LLNL	Lawrence Livermore National Laboratory
NNSA	National Nuclear Security Administration
NRC	National Research Council
OFC	Organizational Facility Charge
RFETS	Rocky Flats Environmental Technology
RPAM	Real Property Asset Management
RPV	Real Property Value
SAT	Space Action Team
S&M	Surveillance and Maintenance
TBD	to be determined
TEC	Total Estimated Cost
TYCSP	Ten Year Comprehensive Site Plan
Type I	Wood structures (typical of temporary or modular buildings)
Type II	Concrete–steel construction with no history of contamination and hazardous/radioactive operations (typical of office buildings)
Type II+	Concrete–steel construction with a history of contamination and hazardous/radioactive operations (typical of technical laboratories in the DOE complex)

Appendix A-1

Building 151 Roof Replacement Support: Explosive Residue Removal

In 1997 LLNL Plant Engineering managed a contract to replace the roof on Building 151, the Chemistry and Materials Science (CMS) Directorate's Nuclear Chemistry Facility. To install a quality roof, equipment on the roof and roof penetrations were to be removed before the contractor work began. SAT supported CMS in its laboratory modifications and, working with Plant Engineering, removed 90 laboratory hood blowers and other roof mounted ventilation system components as the re-roofing proceeded. Over the previous years, chemical operations inside the building involved perchlorate acid evaporations that were vented from hoods inside the building to vents on the roof. Ideally there is little perchloric residue, but under some conditions, the acid vapor can condense on the sheet metal ducting, leaving a potentially explosive residue.

Following a comprehensive protocol to address potential hazards, SAT sampled all the ducts leading to the roof and found significant perchlorate indications in some of the ducts near the roof. Since crushing perchlorate crystals near the duct joints during mechanical removal could cause an explosion, it was essential to develop a process to neutralize the interior of the ducts before removing them. Because the Laboratory had limited experience with that kind of hazard at the time, SAT identified experts at Oak Ridge National Laboratory who came to the site to assist in developing a safe effective procedure.

After a number of iterations, a comprehensive set of processes were developed to assess and then safely remove the duct work. The team devised a non-disruptive technique for flooding the joint area to be separated with a neutralizing solution. Prior to any work being performed, a mock-up training exercise was practiced with full gear to separate several new assembled roof duct work sections (see Figure A-1).

Figure A-1. Photographs of SAT members dry running duct separation for Building 151 project.

The process to neutralize and disassemble the contaminated duct work required each worker to be outfitted in explosives personnel protective equipment and to have all the necessary equipment and tools to validate the techniques for gaining entry to the actual contaminated area. Although there were several suggestions that this approach was excessive, the techniques proved to be sound and several pounds of potentially lethal explosives were neutralized and removed. All subsequent roofing activities were routine. Since that time these proven analytical, mitigation, and removal processes have been successfully used several times on other old chemical facilities found to have similar legacy hazards.

In 2005 the Building 151 experience proved to be of exceptional value. The Building 412 demolition project was nearing completion, which was a Type II+ facility containing several fume hoods in chemistry laboratories with only partial work histories. Interviews with mainly retired building occupants indicated little or no perchlorate work had been done in the building. However, one interview suggested some perchlorates, which was the thread that SAT followed, consistent with all SAT D&D projects. Based on this small but important possibility, all hoods were inspected using the same hood removal procedures and gear developed during the Building 151 project. The last hood examined was in an area with some residual radioactive contamination.

This hood tested positive and, as described in the attached Building 412 SAT Lessons Learned, Appendix A-2, an explosive hazard in a radioactively contaminated area was found and neutralized because of a well established culture of being sure before proceeding on a D&D project.

Appendix A-2

Lessons Learned Building 412

Perchlorate Contamination

Prior to removal of chemical fume hoods 1 and 2, multiple discussions occurred regarding the potential for finding perchlorates in those systems. Interviews with past researchers found little evidence that perchlorates may have been used. One researcher suggested that if perchlorates were used, it would have been in trace amounts. The systems themselves are not currently designed for perchlorate use; however, one interview document stated there was a potential history of pechlorate use in Building 412 hoods.

The project manager was somewhat skeptical that any perchlorates would be found in these systems based on the lack of definitive historical information and the design of the system. After long and meaningful conversations with the SAT Program Leader and safety team, it was determined to approach the system as a potential perchlorate job. This decision was indeed the correct one. Perchlorates were found in the ducting of one hood located in an area with residual radioactive residues (see Figure A-2).

Lessons Learned/Analysis

- Treat a system as perchlorate contaminated if the history suggests anything less than 100% contaminant free.
- System configuration does not always indicate how the system may have been used. Undocumented modifications may have been made.
- Communication and consensus among team members and subject matter experts are critical in the decision-making process. This approach led to a safe and successful project with zero injuries.
- Enlist input from individuals with the appropriate experience to avoid any doubt.
- Treat all suspected perchlorate issues cautiously.

Figure A-2. Perchloric findings in duct work.

Appendix A-3

Building 22X Demolition Pilot Project

In FY98, the IFM Office funded SAT to perform a pilot D&D project to bound the costs and validate their practices for decontaminating and demolishing Type II buildings associated with hazardous operations. Five small buildings summing to 8200 gsf were chosen. Each had been used for a variety of chemical functions involving toxic, explosive, or radioactive materials in support of the recently decommissioned Building 222 CMS Complex. A review of historical records indicated several spills had occurred during its nearly 50-year history. Using state-of-the-art sampling and near real-time chemical and radiological analysis, SAT surgically removed all measurable radioactive and chemical contamination. This process allowed unrestricted demolition and facilitated recycling of nearly 1100 tons of reinforced concrete, steel, wire, wood, fixtures, etc., making up over 98% of the five buildings. Total radioactive waste was less than five 55-gal drums. Conventional hazardous waste, asbestos, lead, and other environmental contaminates made up the rest of the disposal process.

Upon completion, approximately one acre of unrestricted real estate was made available. Consistent with SAT's three previous years working in CMS, there were no injuries or lost work days incurred during the project. In this first project, the fully burdened demolition cost was $203 (in FY99 dollars) per square foot, a very respectable number for a first project on Type II+ reinforced concrete buildings with a history of contamination. This pilot proof of concept and capability project validated the SAT's project and risk management, cost control, and demolition skills and techniques. Based on this performance, SAT was assigned responsibility for cleanup of contaminated legacy buildings and future demolitions.

Appendix A-4

Building 223 Demolition

The demolition of Building 223 was started in 1999 following SAT's successful D&D demonstration pilot in FY98–99 on Buildings 224–226, 228, and 229. This 5862 square foot building was characterized as a support shop for the Building 222 complex and had no indication of radioactive or hazardous activities in any of the discovered safety documentation for Building 223. In the first physical evaluations, the asbestos tile floor was found to have a very thick (~0.5 inch) mastic layer beneath the tile. This unusual condition generated an expanded examination of the building's history that revealed the building had been renumbered to Building 223 in the mid 1950s. Under its original building number a Fire Department run card indicated a plutonium spill had occurred in 1957. With the thick mastic in place, radioactive surveys did not detect any strong signals above background or any definitive signatures of this spill.

Although the record at the Laboratory for cleaning up spills is very good, it was essential to verify that there was no radioactive residue under the mastic. Removing the very thick mastic proved to be a challenge and the D&D effort was put on hold for about 6 months until an acceptable technique was identified and approved for use in the D&D environment. When the mastic was removed, a 30-foot plume of plutonium was found in the concrete floor. This area of contamination was cut from the surrounding concrete floor and the 80 cubic feet of concrete and 9 tons of underlying soil were packaged and disposed of as radioactive waste. The majority of the building concrete (437 tons) was verified to be free of radioactive or other contaminants and was removed and recycled for general use. Although the cost per square foot of the Building 223 project was about 50% higher than the demonstration project, the experience positioned SAT to be able to respond to future unexpected events very safely and cost effectively.

The Building 223 experience is typical of a SAT D&D project. Before any deconstruction begins, the building is surveyed for radioactive, chemical, industrial, and explosives contamination. In parallel, all available technical and operational information is examined to complete constructing an historical record of activities and events in the building to be demolished. When appropriate, employees and former employees are interviewed to construct a more complete record of activities and potential hazards. By building on the experience derived from this process, connections are established to better find data on the next projects to develop an historical data base for the future. Since the IFM has become responsible for all surplus facilities and oversees all facility transfers, a permanent history is now being collected on every building transfer.

Appendix B

Lessons Learned Building 177

In April 2002, SAT was removing the foundation to complete the demolition of Building 177 (a FIRP D&D project). When heavy footings were encountered a Ramhoe was brought in to breakup the thick concrete. During this process, an undocumented and unknown duct bank containing a high voltage (13.8 kV) power cable was discovered under the foundation by crushing the cable and short-circuiting the power line that supplied at least 15 buildings. Fortunately no one was injured, but it was a very significant near miss. After filing an Occurrence Report with DOE, the Laboratory convened a formal Incident Analysis Investigation to identify the causes of this unexpected event.

In any SAT D&D project, identifying, neutralizing, disconnecting, and removing all electrical cables and sources before proceeding with demolition is a well-practiced standard procedure. Similarly multiple underground locations are performed around the building to identify any utility or unknown element that requires special attention. All available drawings are reviewed with Laboratory organizations having cognizance of capabilities in the area. In this case where existing practices were proven inadequate, the Incident Analysis Committee found several significant contributing causes that are summarized below:

- The Laboratory's well-developed location capabilities can sometimes be ineffective when searching for power cables that are under large areas of reinforced concrete.
- Documentation on cable location (which indicated the cables in question were outside the D&D area) was imprecise.
- Current practice of not running power cables under buildings may not have been practiced 50 years ago.
- Taking a narrow project focus that does not consider adjacent structures and distribution vaults that could provide clues to identify unknowns, limits available knowledge.
- All projects must include all participants as full team members to insure clear and effective understanding of roles and responsibilities.

The Root Cause, which if corrected, would most likely prevent the recurrence of a similar event states: Communication of the full scope of work for the complete project to all project participants was less than adequate.

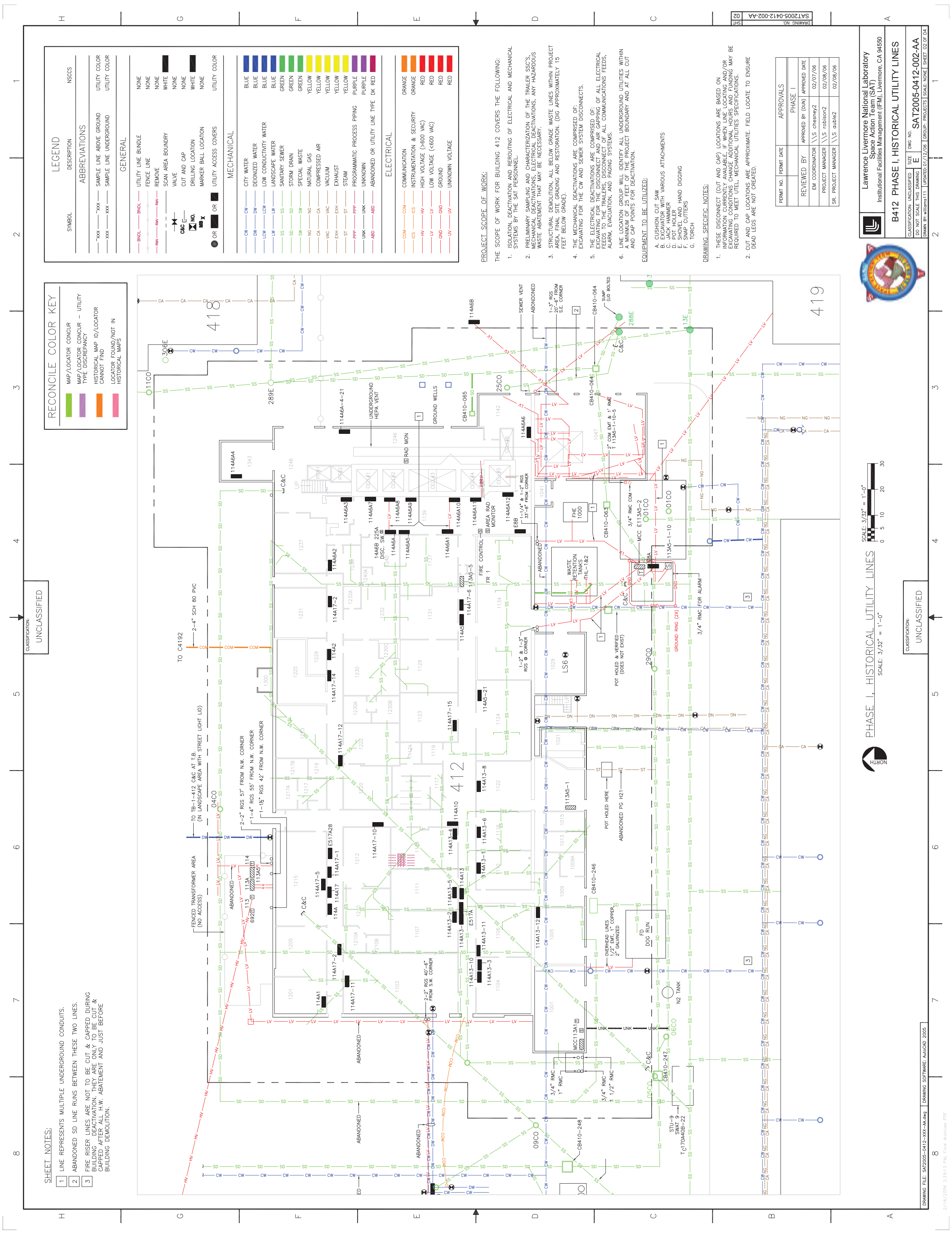
This near miss mobilized SAT to collaborate with the Laboratory's Line Location and Permitting Groups to improve the Laboratory's location effort from over 90% to approach 100%. As a result, a four-phase process was developed:

1) A very detailed color coded CAD map integrating all Laboratory information on below ground power lines, utilities, vaults, sewers, and anything else that might impact safety or cost of a below ground project is generated to document what is known. A minimum of 25 feet is added to the project perimeter to capture location areas conducive to effective location success. Following reviews by all project participants and Laboratory subject matter experts, this "MAP" becomes the official record of what is known. (Schematic 1)
2) The Location and Project personnel work together to verify that the MAP is accurate, to correct any utility discrepancies, to find any components not on the MAP, or to state that some of the components on the MAP can't be found. These data are reviewed with all parties to reconcile unknowns or new findings. Non-destructive excavation techniques are then used to identify or eliminate any unknowns and to provide a final reconciled MAP and associated set of permit requirements. (Schematic 2)
3) After D&D, the MAP is updated to provide a verified new "as built" MAP of the underground landscape. (Schematic 3)
4) This data is then used to update the site master utility maps and documents any conditions requiring future resolution and/or tracking.

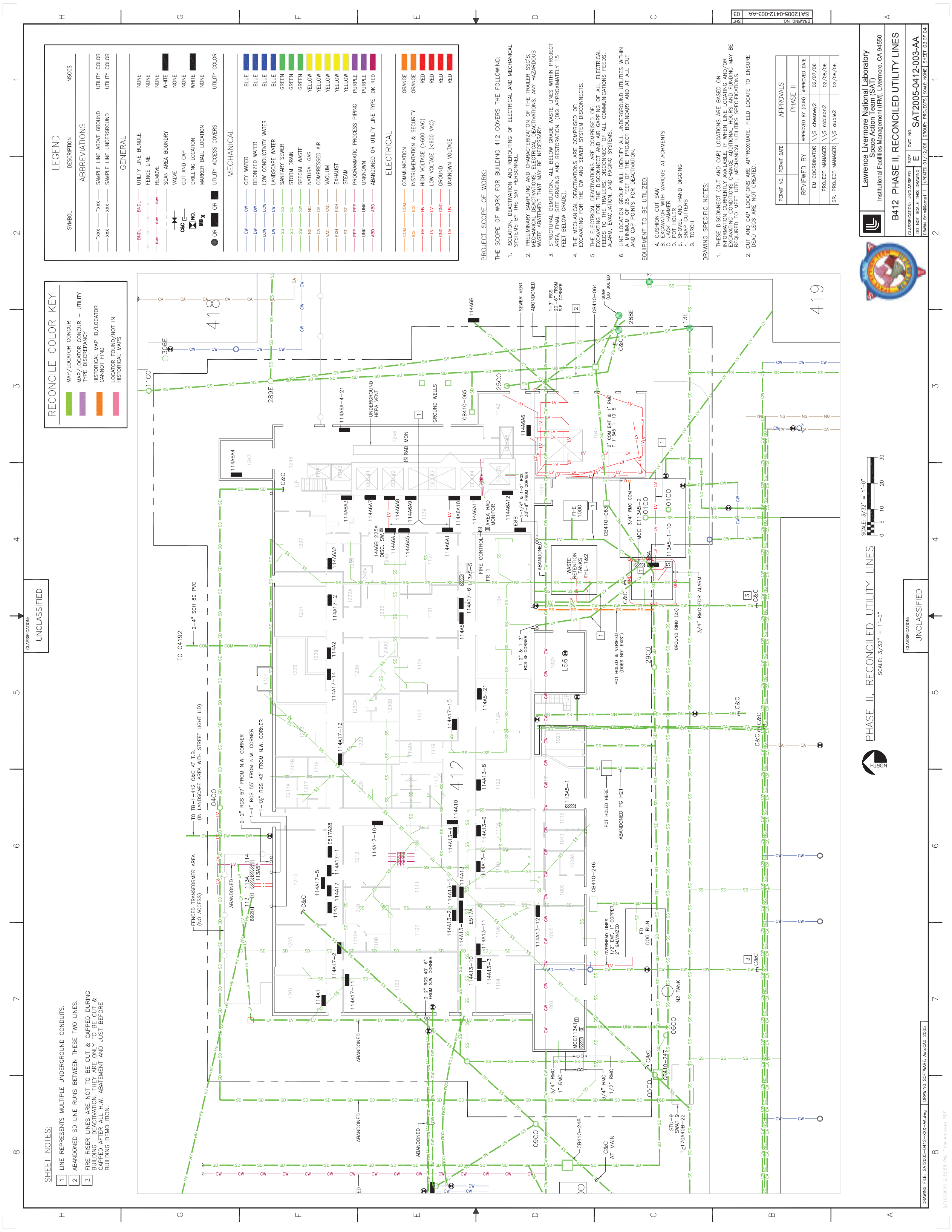
This working MAP approach has been used in all D&D efforts since 2002 with success. The most recent example resolved the presence of two utility pipes just below the reinforced concrete. A drawing indicated their presence (Figure B-1). They could not be verified by any location approach. As Figure B-2 illustrates, verification is sometimes expensive but necessary to perform work safely.

Figure B-1. Area shown to have underground utilities in a site drawing.

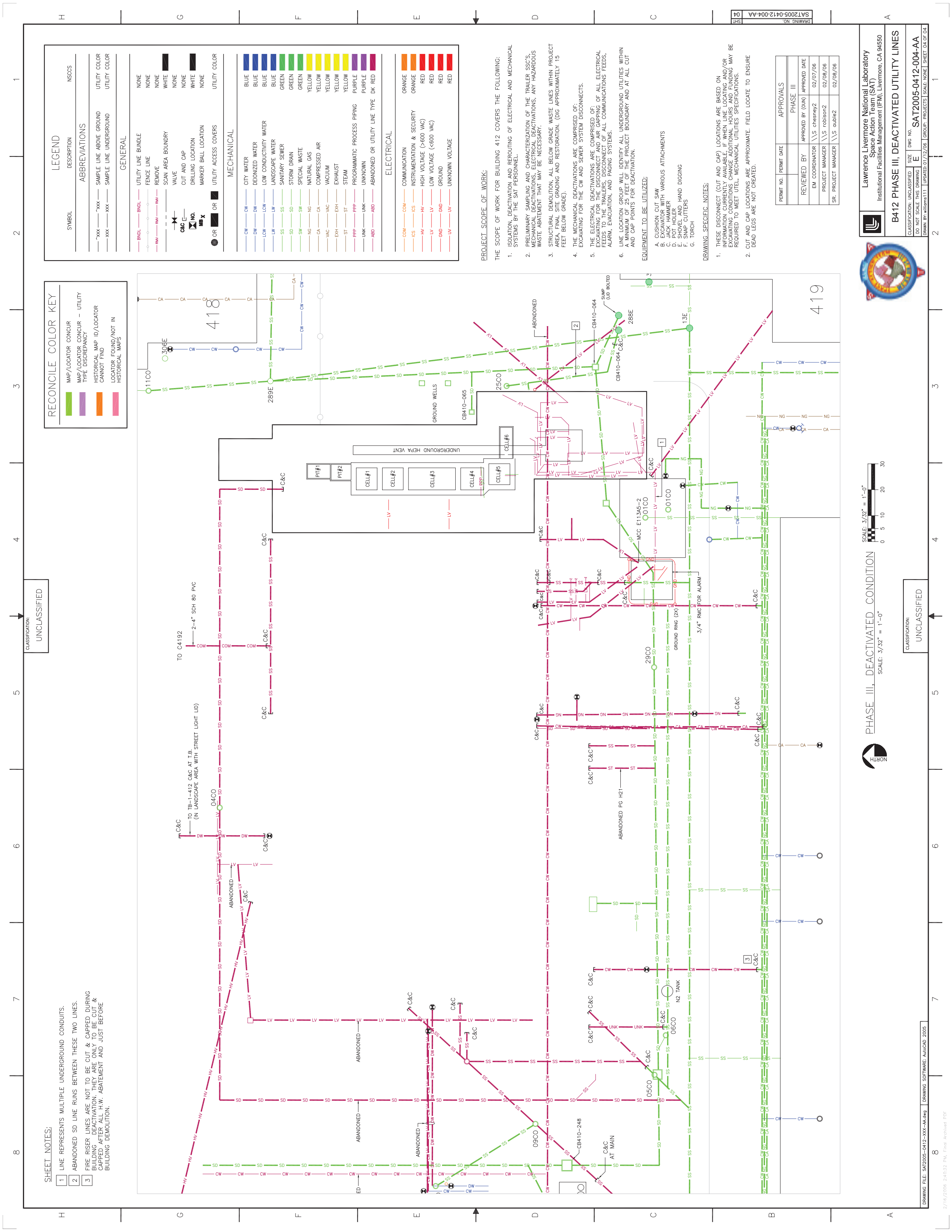

Figure B-2. Verification of map findings by precise removal of concrete.



Schematic 1. Map of historical utility lines.



Schematic 2. Map of reconciled utility lines.



Schematic 3. Map of deactivated utility lines.

Appendix C

NNSA Guidance Summary (November 2004)

In the development of the Facility and Infrastructure Recapitalization Program, Facility Disposition was identified as a key component of the overall program to eliminate the deferred maintenance, operational costs, and risks associated with substandard surplus facilities. The project prioritization ranking process "focused on eliminating surplus facilities (reducing the NNSA footprint) that will provide significant impact on reducing long-term costs and risks." To accomplish this, FIRP placed emphasis on planning, characterizing, and engineering facility disposition projects to establish solid baselines and to provide high probability expectation for successful accomplishment. In concert with the intent of Congress, to make footprint reduction the primary focus of the facility disposition program, NNSA set a complex-wide goal to remove 3M gsf of non-process contaminated facilities between 2002 and 2009. Achieving this goal at average costs that are "consistent with the best industry standards" is an equally important metric, set at approximately $122 per gross square feet. Each site was encouraged to seek "innovative demolition opportunities to achieve low demolition costs while meeting safety and health regulatory requirements." These goals and expectations are consistent with the current and projected LLNL FIRP Facility Disposition Program that, under the planned budgets, scheduled elimination of approximately 600K gsf of substandard surplus space by the end of FY09.

Appendix D

Demolition List by Building Category and Year of Project Completion (Extract from FY06 TYCSP Attachment E-1)

Year	Type II+	Type II	Temporary	Other
1994			1202–1206, 1225, 1276, 4201	
GSF			**27907**	
1995			1391, 1393, 1453, 1901, 2805, 3209, 4106, 5907, 6125	
GSF			**5467**	
1996			410, 413, 417, 852A–D, 1414, 1450, 1459, 1701–1704, 1926, 2103, 2201, 2210, 2226, 2308, 2401–2403, 2410, 2501, 2628, 2678, 2776, 2826, 3156, 3181, 3184, 3384, 3576, 3701, 3727, 3728, 4112, 4125, 4202–4204, 4207, 4392, 5175, 5176, 6126, 8656, 8658	
GSF			**116832**	
1997			215, 1801, 2106, 2581, 3276, 4230, 4390, 5103, 5901–5905	
GSF			**28137**	
1998	225, 226, 228, 229	594	829, 1452, 1705, 1707, 1725, 2175, 2196, 2430, 3425, 3428	
GSF	**4278**	**1570**	**16180**	
1999	224	168, 168A, 169, 334, 595	3675	
GSF	**3923**	**8899**	**12059**	
2000	223	169A–C	6303	
GSF	**5862**	**818**	**588**	
2001	227	160, 183, 184, 414	1738, 2528, 3906, 3926, 3981, 4326, 4386, 4924, 4925, 5102	
GSF	**8640**	**1532**	**17639**	
2002	222S	592	2527	DC Switch Yard
GSF	**33892**	**3456**	**2400**	**92242**
2003			1877	
			1478	
			2626	
			2633	
			2629	
GSF			**25982**	

Appendix D

Demolition List by Building Category and Year of Project Completion (Extract from FY06 TYCSP Attachment E-1) (continued)

Year	Type II+	Type II	Temporary	Other
2004	22C		1253	
	222N515		3903	
	513A		3904	
	514		3905	
	808		3907	
	814		4181	
	820		5928	
	838			
	840A,B			
	865C			
GSF	63865		15177	
2005	412	169	1830	
	232	171	3629	
	854B-G,J	230	4180	
		832F	4440	
			5926	
GSF	41501	12907	19154	
2006	856	431		
	858, 858A	443	2425, 2428, 2512, 2526, 2529, 2530, 4177, 5981–5985	
		444		
GSF	3809	103549	41529	
2007	175	182	1402–1408	
	212	221	1413	
	419	326	1456	
		431B	1477	
		436		
		639		
GSF	78940	72895	43172	
2008				
GSF				
2009	251		1601–1602	
			1927, 2685, 2687, 2726, 2787, 3520, 4161, 4182, 4184, 4352, 4385, 4406	
GSF	31809		43029	

Appendix D

Demolition List by Building Category and Year of Project Completion (Extract from FY06 TYCSP Attachment E-1) (continued)

Year	Type II+	Type II	Temporary	Other
2010			1401,1450, 1826, 1884, 1885, 2525, 2564,2580, 2801, 2802, 2804, 2806-2808	
GSF			**29531**	
2011	813			
	871 A,B,D, E,G,H			
	832A,B			
	855A–C			
GSF	**10034**			
2012	805		2684, 2701, 2775, 2777	
GSF	**6802**		**17235**	
2013	806A–D			
	807			
GSF	**9889**			
2014				
GSF				
2015		162		
GSF		**19197**		

Definitions

Type II+: Concrete-steel construction with a history of contaminatin and hazardous/radioactive operations (typical of technical laboratories in the DOE complex)

Type II: Concrete-steel construction with no history of contaminatin and hazardous/radioactive operations (typical of office buildings)

Temporary: Trailers; modulars.

Other: Non-real property or utility areas not captured in Attachment E.

Appendix E

Partial List of Awards and Recognitions LLNL Space Action Team

LLNL Director's Performance Award for success in implementing the CMS Strategic Consolidation Plan (July 6, 1997).

EPA names Lab a "Champion of Green Government" (*Newsline*, April 2001):
The U.S. Environmental Protection Agency has recognized the Laboratory as a "champion of green government." Recycling materials from decontamination and demolition projects has earned the EPA's Greening the Government Award — recognition and appreciation of individuals and groups that go "above and beyond the call of duty in working to improve the environment. At the heart of the effort is LLNL's Space Action Team created six years ago in the Chemistry and Materials Science Directorate to improve efficiency and reduce costs by helping to consolidate facilities and programs across the Lab. "There were several facilities that were identified as no longer cost-effective to maintain due to their age, changing missions or obsolescence," said Mo Bissani, deputy Space Action Team (SAT) team leader.

Pollution Prevention Award Program, NNSA Oakland Operations Office (September 2001).

"LLNL has made a strong commitment to reducing legacy hazards... ...Teams have been effectively used for the removal or hazardous legacy materials and deactivation of facilities," DOE's Office of Independent Oversight and Performance Assurance 2004 Report — *Management of Legazy Hazards.*

"Implementation of real property assett management (RPAM) throughout DOE would be enhanced if all department sites used LLNL practices and processes as models," National Academies 2004 Report — *Intelligent Sustainment and Renewal of Department of Energy Facilities and Infrastructure.*

NNSA 2006 Annual Pollution Prevention Awards — Best in Class Space Action Team Recycling Category.